Before the
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

In the Matter of

Amendment of Parts 2 and 25 of the)
Commission's Rules to Permit Operation)
of NGSO FSS Systems Co-Frequency with)
GSO and Terrestrial Systems in the Ku-Band)

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ET Docket No. 98-206

SUPPLEMENTAL COMMENTS OF SKYBRIDGE

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SUMMARY

SkyBridge hereby responds to the Commission's request for comment on the agreements recently concluded at the ITU-R Conference Preparatory Meeting ("CPM") related to NGSO FSS systems. The CPM reached consensus on power limits and related provisions to facilitate introduction of NGSO FSS systems in the Ku-band, while adequately protecting existing GSO FSS, GSO BSS and FS systems. The agreements reached at the CPM will be proposed to the World Radiocommunication Conference scheduled for next year for inclusion in the ITU Radio Regulations. SkyBridge fully supports the CPM agreements.

The CPM result represents the culmination of a two-year effort within the ITU-R to develop appropriate "rules of the road" to govern frequency sharing among new NGSO FSS systems and various incumbent services, including GSO systems. Certain of the issues involved were especially contentious, most notably the power limits that will apply to NGSO FSS downlinks for the protection of GSO earth station receivers (the "$EPFD_{down}$" limits).

The CPM achieved a consensus that resolved this impasse, by combining three different kinds of $EPFD_{down}$ limits, each addressing a different concern and serving a different purpose. Some of these $EPFD_{down}$ limits are to be evaluated by the ITU-R Radiocommunication Bureau using a software program that computes a worst-case upper bound of the interference an NGSO system could generate. Other, stricter,

limits will apply only to the actual $EPFD_{down}$ levels generated by a system into operational GSO earth stations, and are therefore not subject to software validation.

For the reasons detailed in these comments, SkyBridge fully supports this consensus. If implemented as intended by the CPM, these provisions will satisfy the WRC-97 mandate to adequately protect GSO FSS systems, while avoiding undue burdens on any of the services involved. SkyBridge therefore urges the Commission to follow both the spirit and the letter of the CPM consensus, and adopt the rules outlined in these comments to govern NGSO FSS operation in the Ku-band.

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SkyBridge L.L.C. ("SkyBridge"), by its attorneys, hereby submits its

comments in response to the Public Notice released by the Commission on December 6,

1999,[1] seeking comment on the agreements related to Non-Geostationary Orbit

("NGSO") Fixed-Satellite Service ("FSS") systems recently concluded at the ITU-R

Conference Preparatory Meeting ("CPM"). SkyBridge also responds to the *ex parte*

filing of the PanAmSat Corporation ("PanAmSat"), dated December 6, 1999, on this

topic (the "PanAmSat Letter").

As explained in the Public Notice, the CPM reached consensus on power

limits and related provisions to facilitate frequency sharing in the Ku-band between new

NGSO FSS systems and Geostationary Orbit ("GSO") FSS, GSO Broadcasting-Satellite

Service ("BSS") and Fixed Service ("FS") systems. The agreements reached at the

CPM will be proposed to the World Radiocommunication Conference scheduled for

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[1]   Public Notice, DA 99-2733, rel. December 6, 1999 (the "Public Notice").

next year ("WRC-2000") for inclusion in the ITU Radio Regulations. For the reasons given below, SkyBridge fully supports the CPM agreements, as detailed in Chapter 3 of the CPM Report on technical, operational and regulatory/procedural matters to be considered by the 2000 World Radiocommunication Conference ("CPM Report").[2/]

I.   BACKGROUND OF THE CPM CONSENSUS

The consensus reached at the CPM represents the culmination of a two-year effort within the ITU-R to develop appropriate "rules of the road" to govern frequency sharing among new NGSO FSS systems and various incumbent services, including GSO FSS and GSO BSS systems. WRC-97 officially commenced this international effort with its adoption of provisional equivalent power flux-density ("EPFD") limits for NGSO FSS systems (the "WRC-97 Limits"), and its creation of the Joint Task Group 4-9-11 (the "JTG") to conduct technical studies and revise the WRC-97 Limits as appropriate.

As stated in WRC-97 Resolutions 130, 131, and 538, a key objective for the JTG was to ensure that the EPFD limits place no undue constraints on any of the services involved. Following this mandate, the JTG undertook a comprehensive study of all aspects of the GSO/NGSO interference environment to determine the best way to

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[2/]   In particular, SkyBridge supports the agreements reached regarding NGSO FSS sharing with GSO FSS, GSO BSS, FS, Radiolocation and Space Sciences systems, as well as the special provisions for the protection of "very large" GSO earth stations and slightly-inclined orbit GSO systems. However, in these comments, SkyBridge focuses on the consensus approach proposed by the CPM for protection of GSO FSS earth stations from NGSO FSS downlink interference, which is also the topic of the PanAmSat Letter.

facilitate sharing among NGSO and GSO systems, with the goal of developing technically rigorous limits and regulatory procedures to be proposed to (and, hopefully, adopted at) WRC-2000.[3/] Although work toward this end progressed steadily, resolution of certain key issues was complicated by a variety of factors.

Most importantly, in response to concerns expressed by the GSO community and regulators with regard to the difficulty of assessing the power transmitted to a GSO earth station from an NGSO system as a whole, the JTG agreed, with both GSO and NGSO support, that compliance with the EPFD limits should be verified by the ITU Radiocommunication Bureau ("BR"), using software specified by the JTG to ensure that the EPFD limits are met at all times, at every point on earth, by each NGSO FSS system. However, it was quickly recognized that this software could not be based on parameters that could change over the life of the NGSO system, such as the number of beams illuminated and their pointing directions at any given time.

[3/]   As part of this effort, the JTG (i) studied the characteristics of the GSO systems to be protected, (ii) defined protection criteria for GSO systems, and (iii) based on these parameters, determined the level of interference that could be accepted from NGSO FSS systems. Using an agreed upon methodology, this "aggregate" interference was used to derive "single entry" power limits, to be placed in the ITU Radio Regulations to govern the operation of each NGSO FSS system. For detailed discussions of these studies and their results, see, e.g., Comments of SkyBridge, ET Docket No. 98-206, RM-9147, RM-9245, filed March 2, 1999 ("SkyBridge NPRM Comments"), at 25; Reply Comments of SkyBridge, ET Docket No. 98-206, RM-9147, RM-9245, filed April 14, 1999 ("SkyBridge NPRM Reply Comments"), at 13; Ex Parte letter of SkyBridge in response to ex parte letter of the Satellite Coalition, ET Docket No. 98-206, RM-9147, RM-9245, dated November 10, 1999; Ex Parte submission of SkyBridge, ET Docket No. 98-206, RM-9147, RM-9245, dated December 3, 1999, containing relevant inputs and outputs of the various ITU-R study groups addressing these issues.

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Moreover, the JTG wanted an open validation procedure, and beam switching algorithms contain highly sensitive commercial information regarding market demand.

The JTG therefore developed a software specification that employs a number of worst-case and simplifying assumptions, including a worst-case beam configuration for the satellites of each system. It was agreed that this was the only feasible means for ensuring that a generic software program captures the worst-case possible by a given NGSO FSS system that may occur at some place and time, while still permitting each NGSO system the necessary flexibility to adjust its operation in response to demand for services. As a result, however, the software does not predict the actual EPFD statistics that will be produced by a system in operation, but rather computes a very conservative upper bound. The software will therefore overestimate the amount of interference generally experienced by GSO systems, making it more difficult for an NGSO system to demonstrate compliance with any given set of EPFD limits.[4]

These assumptions employed in the software tool are especially important when assessing the $EPFD_{down}$ limits for the larger GSO antenna sizes, for which the JTG debate was especially contentious.[5] One concern with respect to these

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[4]   For example, as SkyBridge has stated to the Commission on prior occasions, the SkyBridge system can, *in operation*, meet the WRC-97 Limits. However, it could not meet the WRC-97 Limits when evaluated with the assumptions employed in the JTG software, due to the overestimation of SkyBridge interference produced by the software.

[5]   EPFD limits have been derived for the uplink, downlink, and inter-satellite

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large antennas stems from the fact that their high gain makes them more susceptible to interference from NGSO systems during certain (brief) geometrical alignments of the NGSO satellite and GSO satellite and associated receive antenna. If the interference were high enough, loss of synchronization ("sync loss") of the GSO signal could occur. However, JTG studies have shown that the worst-case interference from an NGSO system into large earth stations is localized.[6] The conservative upper bound computed by the BR software hides this important phenomenon.

These considerations significantly complicated the sharing debate. The solution from the NGSO point-of-view was to take into account the conservative nature of the software in developing revised $EPFD_{down}$ limits. However, a small minority of GSO operators objected to this approach, claiming that it would not adequately protect their systems, assuming an NGSO system could actually operate at those $EPFD_{down}$ limits and still pass the validation test. These GSO operators wanted additional assurance that the conservative nature of the software results, and the geographic localization of the maximum $EPFD_{down}$ levels, would, in practice, lead to greater

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[5]   (...continued)
paths. The limits on downlink interference ("$EPFD_{down}$") are the subject of the consensus reached at the CPM. Although not discussed in these comments, SkyBridge also supports the $EPFD_{up}$ and $EPFD_{is}$ limits developed by the JTG and contained in the CPM Report for the protection of GSO FSS and GSO BSS systems.

[6]   See, e.g., SkyBridge NPRM Comments at 36; *Ex Parte* letter of SkyBridge in response to *ex parte* letter of the Satellite Coalition, ET Docket No. 98-206, RM-9147, RM-9245, dated November 10, 1999, at 3-5.

protection of their earth stations than implied by the $EPFD_{down}$ limits to be placed in the Radio Regulations.

Balancing these considerations, the CPM achieved a consensus that resolved this impasse, by combining three different kinds of $EPFD_{down}$ limits, each addressing a different concern and serving a different purpose. As discussed below, some of these $EPFD_{down}$ limits are to be evaluated using the BR software as part of the ITU notification process, while other, more stringent limits, will apply only to the actual $EPFD_{down}$ levels generated by an NGSO system into operational GSO earth stations, and are therefore not subject to software validation.

II.   SUMMARY OF THE CPM CONSENSUS

A.   "Validation" Limits

The first set of limits for GSO protection proposed by the CPM are the so-called "validation" $EPFD_{down}$ masks (referred to herein as the "Validation Limits"). These reflect the goal of the JTG, described above, to have a set of limits that can be readily checked using a generic software tool as part of the ITU notification process. The Validation Limits comprehensively bound the full $EPFD_{down}$ statistics of each NGSO FSS constellation into a variety of GSO earth station antenna sizes and locations.[2]

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[2]   See CPM Report § 3.1.2.1.4(c). Some GSO proponents expressed concerns about the ability of the Validation Limits to protect GSO antennas at higher latitudes, where larger antennas are often used to compensate for the low elevation angle inherent in such links and the reduced power transmitted towards those regions (this is particularly the case for BSS applications in Alaska, for

(continued...)

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In the international arena, compliance with the Validation Limits will be assessed by the BR, using the software tool discussed above. The specification for the BR software is complete.[8/] Several administrations and other organizations are currently developing software based on this specification, with the goal of providing candidate software to the BR by mid-January 2000, so that selection of software can be approved before WRC-2000.[9/] As the Commission is aware, SkyBridge has taken an active role in developing the software specification, and will continue its efforts to ensure that the software development process is concluded swiftly.

The JTG determined that the BR software validation should be an open process. The software, as well as all input parameters provided by administrations will be available to all administrations. For the computation of $EPFD_{down}$, this information includes power flux density ("PFD") masks to be supplied by the notifying administration, representing the maximum PFD generated by each NGSO satellite.[10/]

[7/]   (...continued)
example). In response to these concerns, the CPM agreed to additional tighter $EPFD_{down}$ limits, applicable at the higher latitudes. See CPM Report, Annex 1 to Chapter 3, Tables S22-1A', S22-1D, n.2. SkyBridge supports this approach.

[8/]   See CPM Report §§ 3.1.2.1.4(c), 3.1.5.1, 3.1.2.4.6; ITU-R Recommendation [Doc. 11/153], adopted by Study Group 11 on December 17, 1999.

[9/]   See CPM Report, §§ 3.1.5, 3.1.5.2.

[10/]   These masks are computed assuming the worst-case beam configuration, and are specified as a function of the angular separation between the NGSO satellite and the GSO arc.

The parameters and software used to compute the masks will also be provided.[11] In this way, administrations can independently verify the BR results, if they so wish.

B.   "Operational" Limits

The second set of limits have been referred to as "operational" $EPFD_{down}$ limits ("Operational Limits"). These limits bound the maximum $EPFD_{down}$ that an operational NGSO FSS system may transmit into operational GSO FSS earth stations of varying sizes.[12]

The Operational Limits are more stringent limits than the Validation Limits, and are therefore more constraining on the NGSO operator. They apply to each NGSO system in operation, and not to the conservative upper bound calculated by the BR software. They were designed to address the concern of GSO operators regarding the degree of conservativeness of the BR software, in terms of the likelihood of having an NGSO system actually generating a high level of $EPFD_{down}$ into larger GSO FSS earth stations. In particular, they ensure protection of these larger GSO earth stations against sync loss.[13]

For these reasons, compliance with the Operational Limits is not to be assessed using the BR software; the BR will assess compliance only with the Validation

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[11]   CPM Report § 3.1.5.1. Similar information is also required for the computation of $EPFD_{up}$ and $EPFD_{is}$.

[12]   CPM Report §§ 3.1.2.1.4(c), 3.1.2.4.7. As opposed to the Validation Limits, which prescribe an $EPFD_{down}$ mask as a function of all percentages of time, the Operational Limits are defined only for 100% of the time.

[13]   CPM Report § 3.1.2.1.4(c).

Limits.[14] Moreover, because the Operational Limits apply to operational $EPFD_{down}$ levels received by actual GSO earth stations, no demonstration by the NGSO operator of compliance with these limits is required. However, once in service, should an operating NGSO system exceed the Operational Limits into an operational GSO earth station, the JTG and CPM agreed that all necessary steps to ensure that interference levels into that earth station are restored to the Operational Limits would have to be taken by the NGSO network as expeditiously as possible. Such a determination would be made by individual administrations, upon review of relevant technical data provided by the affected GSO and NGSO operators.[15]

As noted in the CPM Report, a reliable means of measuring the actual $EPFD_{down}$ levels generated by an NGSO system into operational GSO earth stations would assist operators and administrations in determining compliance with the Operational Limits in the event of a dispute.[16] This is expected to be developed within the ITU-R as a draft new Recommendation prior to WRC-2000.[17] SkyBridge supports these efforts, and will work with other participants at the next meeting of WP 4A to achieve this goal.[18] Moreover, SkyBridge supports the preliminary outline for a

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[14]   CPM Report § 3.1.2.4.7.

[15]   CPM Report § 3.1.2.4.7.

[16]   CPM Report § 3.1.2.4.7; see also § 3.1.2.4.8.

[17]   CPM Report § 3.1.2.4.7.

[18]   In fact, a Preliminary Draft New Recommendation already exists on this topic. See Document 4A/TEMP/167.

regulatory procedure for resolving such disputes that is outlined in Annex 8 to Chapter 3 of the CPM Report.[19]

C. "Additional Operational" Limits

The final aspect of the CPM consensus approach is the "additional operational" $EPFD_{down}$ limits ("Additional Operational Limits"), which apply to 3 and 10 meter GSO earth stations. As in the case of the WRC-97 Limits, these are specified as points of $EPFD_{down}$ at specific percentages of time.[20] These limits were based on a U.S. proposal.

As with the Operational Limits, the Additional Operational Limits are more stringent than the Validation Limits, and are intended to give GSO operators further assurance regarding the actual EPFD statistics of each NGSO system, in operation. Therefore, these limits are not to be assessed using the BR software.[21] As the Commission knows, the intention of the CPM regarding these limits was that "the administration proposing the non-GSO system shall commit that, when in service, the interference from that system into any operational antenna of diameter 3 m [and 10 m]

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[19]   As noted in Annex 8 of the CPM Report, several outstanding issues remain in finalizing this procedure, and additional regulatory work on this procedure is needed. See CPM Report § 3.1.2.4.7.

[20]   CPM Report § 3.1.2.1.4(c).

[21]   ITU-R studies have demonstrated that NGSO systems in operation will produce EPFD statistics lower than predicted with the BR software, and have demonstrated in particular the ability of certain individual systems, such as SkyBridge, to meet the Additional Operational Limits. See, e.g., Documents JTG 4-9-11/243 and JTG 4-9-11/245.

will meet the additional operational limits. . . "[22] Such commitment would be made in the Appendix S4 submission sent by the filing administration of the system.

As indicated in the CPM Report, ITU-R Recommendations to assist administrations in making such commitments are needed, and a Resolution by WRC-2000 requesting development of Recommendations for checking compliance with the Additional Operational Limits is therefore proposed.[23] SkyBridge supports this proposal, and will work toward development of such methodologies during the next ITU-R study period.

D.   Aggregate Interference

All of the limits discussed above are "single entry" limits, and apply to each NGSO FSS system individually.[24] Recognizing that it is the aggregate interference produced by all NGSO FSS systems operating co-frequency that is of primary concern to GSO operators, the CPM is proposing an example WRC-2000 Resolution, contained in Annex 2 of the CPM Report ("Example Resolution WWW"), as a possible regulatory mechanism for ensuring that the aggregate levels used to derive the single entry Validation Limits are not exceeded as multiple NGSO FSS systems commence service.[25]

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[22]   CPM Report § 3.1.2.1.4(c); see also § 3.1.2.4.8.

[23]   CPM Report § 3.1.2.4.8.

[24]   See supra note 3.

[25]   See CPM Report §§ 3.1.1.3.2, 3.1.6.1, and Annex 2.

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Example Resolution WWW provides that administrations operating NGSO FSS systems should take all possible steps to ensure that the actual aggregate interference into GSO networks caused by such systems do not exceed specified levels, and should this occur into an operational GSO earth station, such administrations shall expeditiously take all necessary measures to reduce the aggregate EPFD levels to the specified levels (or higher acceptable levels). It further requests the ITU-R to develop a methodology for calculating the aggregate $EPFD_{down}$ levels produced by multiple systems. SkyBridge supports this approach.[26]

III. PROPOSED COMMISSION RULES BASED ON THE CPM CONSENSUS

As demonstrated above, each of the three $EPFD_{down}$ limits proposed by the CPM addresses a separate concern of NGSO or GSO operators, and each requires a different regulatory treatment. SkyBridge outlines below ways for the Commission to incorporate the CPM consensus into the Commission's rules, consistent with the function of each limit and the intent of the CPM, as well as the specific operational environment of satellite communications in the U.S.

A. Validation Limits

As discussed above, the Validation Limits were developed by the JTG for determining the ability of a system to protect GSO systems as part of the

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[26] In principle, this differing regulatory treatment of single entry and aggregate interference levels can be compared to the single-entry coordination threshold between GSO systems (noise temperature increase of 6%) and the recommended aggregate interference from adjacent GSO systems (noise temperature increase of 20%).

notification process. The Commission should therefore incorporate the single entry Validation Limits into its rules, and, as discussed below, require a demonstration of compliance with these limits.[27/]

As part of such provisions, the Commission should require all applicants to provide all of the information required by the BR for validation (noted in Section II.A above).[28/] Indeed, for systems for which the U.S. is the notifying administration, it is the Commission that will need to forward this information to the BR.[29/]

In terms of how compliance should be demonstrated, the Commission has two choices. Because the software, and all of the information provided to the BR, will be available to administrations, the Commission could choose to rely on the

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[27/] As SkyBridge and other NGSO FSS applicants have demonstrated in prior filings with the Commission, expeditious licensing of NGSO FSS systems is vital to promoting the build-out of such systems. See, e.g., Opposition of SkyBridge L.L.C., File Nos. SAT-AMD-19980630-00056; SAT-AMD-19990108-00004, filed August 4, 1999, at 3-10. It is not necessary that compliance with the BR validation software be completed before licensing, only that compliance has been verified before a system enters service. Therefore, the Commission may proceed to grant licenses to qualified NGSO FSS applicants, in each case conditioned on a demonstration of compliance with the Validation Limits.

[28/] PanAmSat proposes that each NGSO applicant be required to submit to the Commission a maximum per-satellite PFD mask. PanAmSat Letter at 5. In fact, such masks are an input to the BR software and must therefore already be provided by each applicant. There is no need for a separate Commission rule requiring such masks.

[29/] This is expected to take the form of an additional Appendix S4 filing, containing the data items specified in Annex 9 to Chapter 3 of the CPM Report.

validation conducted by the BR, knowing that all of the information used by the BR is available to resolve any dispute regarding whether a system meets the Validation Limits contained in the Commission's rules. On the other hand, the Commission could undertake such validation itself, using the same software tool as the BR. Either option is acceptable to SkyBridge.

Once compliance with the Validation Limits has been demonstrated using the BR software, this requirement of the FCC rules should be considered satisfied, assuming the NGSO system continues to operate within the parameters provided to the BR and the Commission.[30] Consistent with the Commission's rules and practices applicable to other services and systems, the Commission should require that NGSO FSS applicants report to the Commission any change in system characteristics that would cause the system to perform outside the envelope defined by the parameters provided to the BR and the Commission, so that validation using the BR software can be reconfirmed.[31]

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[30]   PanAmSat states that incorporation of the single entry Validation Limits and the PFD masks used by the BR software into the Commission's licensing process will provide GSO operators a domestic remedy if interference to their systems results, despite the applicant's showing of compliance with these limits. PanAmSat Letter at 3. It is not clear how the Validation Limits can perform such a function. Providing recourse to GSO operators in the event of interference in excess of the limits is the purpose of the more stringent Operational Limits, which can more readily be measured.

[31]   In such cases, for U.S.-notified systems, the Commission will need to forward this updated information to the BR.

B. Operational Limits

As explained above, the Operational Limits were designed to assure GSO operators that the maximum $EPFD_{down}$ values from each NGSO system into operational GSO earth stations will be below defined values, and to provide recourse in the event that they are not. The Commission should incorporate the Operational Limits into its rules, which already provide procedures for resolving interference complaints.[32]

As noted above, the ITU-R is currently working on a Recommendation specifying a procedure for determining, via measurements, whether an NGSO system is exceeding the Operational Limits into an operational GSO earth station antenna, to aid administrations in this regard. Also, the CPM agreed to an outline of a procedure for dispute resolution.[33] SkyBridge urges the Commission to follow the proposals of the CPM Report, and incorporate by reference in the Commission's rules the assessment procedures for the Operational Limits ultimately developed by the ITU-R.

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[32]   See, e.g., 47 C.F.R. §§ 25.271-25.274.

[33]   In order to determine the source of any violation of the Operational Limits, it will be necessary to include in the ITU-R measurement Recommendations a mechanism for identifying the satellites of each NGSO constellation. This may involve, for example, a means for ensuring the availability of ephemeris information for each of the constellations. The Commission should follow the mechanisms developed by the ITU-R working groups in this regard. As a practical matter, the Commission already has full authority to require any of its licensees -- whether space segment or earth station -- to provide any necessary technical data on request, including such ephemeris information, in the event of a credible claim of interference, as an aid to resolving the dispute. See 47 C.F.R. §§ 25.273-25.274.

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Ultimately, the Commission already has at hand a number of ways to deal with any proven non-compliance with the operational limits. If any of the Commission's operational requirements are violated, the Commission has the authority to require that the operator reduce its power so that it is within specified limits, as well as the authority to require a system operator to cease operations if it fails to do so. The Commission also may impose forfeitures against its licensees for violation of its rules, or, in extreme cases, revoke the relevant operational license.[34/]

PanAmSat asks the Commission to go further, and require that NGSO applicants demonstrate compliance with operational limits at the outset, as part of the licensing process.[35/] This is clearly not consistent with the principle behind the Operational Limits, however, as PanAmSat knows full well. As discussed in Section II.B above, the Operational Limits are intended to provide a GSO operator with a standard to determine whether its system is receiving impermissible interference into an operational GSO earth station. Moreover, due the technical considerations explained in Section I above, the proposal of PanAmSat to employ software validation of limits that apply to the operational $EPFD_{down}$ levels produced by an NGSO system[36/] was specifically and soundly rejected at the CPM.

[34/] See, e.g., 47 U.S.C. § 312; 47 C.F.R. § 25.160.

[35/] PanAmSat Letter at 3.

[36/] See PanAmSat Letter at 5-6.

C. Additional Operational Limits

Finally, the Additional Operational Limits were developed to provide further assurance that the actual $EPFD_{down}$ statistics from any given NGSO system would, in operation, fall below specified points, consistent with NGSO commitments that this would be the case. Again, SkyBridge proposes that the Additional Operational Limits be incorporated into the Commission's rules.

As noted by PanAmSat, such statistics may be difficult to verify by measurement.[37] Moreover, software cannot be used to provide a regulatory verification of the Additional Operational Limits, because, as explained above, the actual operational $EPFD_{down}$ statistics of a given NGSO system into a given GSO receiver will change with time, and will convey proprietary information. Therefore, consistent with the intent of the CPM in developing these limits, SkyBridge proposes that the Commission require each NGSO FSS system to commit, as part of the application process, to meeting the Additional Operational Limits once in service.

In support of this commitment, the Commission should require that each licensee be prepared to demonstrate the technical basis for its commitment to the Commission, on request, in the course of any investigation into an alleged violation of the Additional Operational Limits. [38] The basis for such commitment will presumably be detailed simulations of the constellation, employing actual operational parameters.

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[37] PanAmSat Letter at 3.

[38] Such a requirement would parallel that applicable to FSS earth station antenna performance requirements. See 47 C.F.R. §§ 25.209, 25.132.

Although these simulations will change from time to time and reflect commercially sensitive information, and therefore should not be required to be submitted as a pre-condition to licensing or operation, a licensee must be prepared to make an appropriate demonstration of compliance to the Commission in the event of a credible claim of a rule violation. Because these detailed simulations can contain highly proprietary information, the Commission should be prepared to afford confidential treatment to any such submission, consistent with existing Commission rules.[39]

Such an approach is fully consistent with the regulatory treatment of other satellite systems, including GSO systems, in the Commission's rules. For example, the Commission's limits on PFD for the protection of FS systems, and frequency tolerance and emission limitations, applicable to all FSS operations, are simply a condition of each license, and are not subject to measurement or other validation except in the context of a dispute.[40] Similarly, the FSS antenna performance standards of Section 25.209 are governed by a compliance certification requirement.[41] In such cases, the Commission relies on each operator to honor the commitments contained in their applications to abide by such rules, knowing full well that failure to do so could lead to loss of their license and other sanctions.

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[39]   See 47 C.F.R. §§ 0.457-0.459.

[40]   See 47 C.F.R. §§ 25.202, 25.208.

[41]   47 C.F.R. § 25.132.

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Notwithstanding these considerations, PanAmSat asserts that the Commission should adopt a software compliance procedure for the Additional Operational Limits.[42] Although SkyBridge supports the proposal in the CPM Report that methods be further studied for computing actual $EPFD_{down}$ statistics,[43] for the reasons given above, software cannot be used as a regulatory tool in this case because the actual $EPFD_{down}$ statistics from an NGSO FSS system will change over time. While an applicant could provide *example* simulation outputs[44] demonstrating compliance with the Additional Operational Limits, such outputs would serve little regulatory purpose, because the statistics will change over time (while still remaining below all three kinds of $EPFD_{down}$ limits). Moreover, as PanAmSat and the Commission are well aware, the parameters used to generate such outputs are highly proprietary, as they involve the actual switching algorithms used to provide capacity to various markets. These are precisely the considerations that led the JTG and CPM to implement both "validation" and "operational" limits. PanAmSat's efforts to convert the operational limits into validation limits is both unworkable from a practical perspective and flatly inconsistent

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[42]   PanAmSat Letter at 5.

[43]   CPM Report §§ 3.1.2.1.4(c), 3.1.2.4.8. In fact, considerable work has already been undertaken in WP 4A and the JTG on such techniques. The availability of simulation methodologies that more accurately predict the actual $EPFD_{down}$ statistics of an NGSO system in operation than the BR software may be useful to NGSO operators in assuring their systems will meet the Additional Operational Limits (particularly in view of the difficulty of measuring such levels), and to administrations in resolving any disputes that arise.

[44]   As discussed above, the inputs to such simulations contain proprietary information.

with the principles of the CPM consensus; in short, PanAmSat's proposal must be rejected.

PanAmSat has also proposed that software verification should include the generation of maps showing the maximum NGSO interference power levels that could be received in the U.S., with a 1° resolution.[45/] This proposal, which again amounts to software validation of operational limits, was extensively discussed and rejected within the ITU-R process. As SkyBridge has pointed out to PanAmSat numerous times, the maximum NGSO levels produced by a system will change over time. Again, while *example* maps could be provided, they would, in practical terms, be meaningless, as they will quickly become obsolete. Moreover, even if updated often, such maps would be of no use to GSO operators. Maps showing the worst-case locations at a particular time due to use of a particular switching schedule cannot be reliably used for locating GSO earth stations, for example, because the worst-case location may later change. Put simply, PanAmSat's proposal has no possibility of providing the assurances that PanAmSat ostensibly seeks.

[45/] PanAmSat Letter at 3, 5-6.

D.   Aggregate Interference

PanAmSat proposes that each NGSO applicant provide documentation demonstrating that it meets the aggregate levels contained in Example WRC-2000 Resolution WWW. PanAmSat proposes that each applicant use for this purpose software that calculates the $EPFD_{down}$ statistics for prior-licensed NGSO systems.[46]

There are numerous problems with such a proposal. As stated in Example Resolution WWW, the aggregate levels contained therein govern the aggregate emissions of the operational NGSO systems at any given time.[47] Once more, it is not practical, from a regulatory standpoint, to require operators to provide software that calculates actual $EPFD_{down}$ statistics at given GSO earth station locations, which are inherently subject to change. Therefore, software validation of the aggregate levels is not appropriate.

Furthermore, these operational levels are determined by the combined interference stemming from all of the operating constellations, including constellations

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[46]   PanAmSat Letter at 5.

[47]   This difference from the Validation Limits was intentional. It was recognized in WP 4A and the JTG that employing software validation, like the BR software procedure associated with the single entry Validation Limits, is not appropriate for aggregate interference calculations. As explained above, at note 26, such differing treatment of the single entry and aggregate interference levels has parallels in the context of GSO systems. SkyBridge supports both the regulatory approach and the values of aggregate levels contained in Example Resolution WWW, which were integral parts of the consensus reached at CPM.

that may not be serving the U.S.[48/] For this reason, compliance with the aggregate

levels must be assessed on an international level.[49/]

As noted in the CPM Report, the ITU-R will continue its studies of this

issue. SkyBridge urges the Commission to allow the development of Example

Resolution WWW to mature. It should be kept in mind that the aggregate level is based

on 3.5 effective NGSO FSS systems all producing interference at the level of the

Validation Limits. As evidenced by the applications on file with the Commission, it

will be some years before enough systems will be operating at power levels sufficient to

reach the aggregate levels, providing time for appropriate international agreements to

be developed to ensure that the aggregate levels used as the basis of the single entry

Validation Limits are not exceeded in practice.

[48/] As the Commission is aware, side-lobe interference from NGSO FSS system
serving neighboring regions can contribute to the aggregate interference at
locations in the U.S.

[49/] For these reasons, SkyBridge opposes PanAmSat's suggestion that the aggregate
values contained in Example Resolution WWW should be placed in the
Commission's rules. They have no meaning for individual systems, and
necessarily must be governed on an international level.

CONCLUSION

In sum, SkyBridge fully supports the CPM Report, including the consensus reached by the CPM for the protection of GSO FSS earth stations from NGSO FSS downlink interference. If implemented as intended by the CPM, these provisions will satisfy the WRC-97 mandate to adequately protect GSO FSS systems, while avoiding undue burdens on any of the services involved. SkyBridge therefore urges the Commission to follow both the spirit and the letter of the CPM consensus, and adopt the rules outlined above to govern NGSO FSS operation in the Ku-band.

Respectfully submitted,

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